GB1210013

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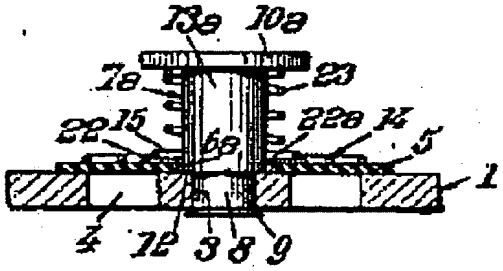
Abstract of **GB1210013**

1,210,013. Valves. ETABS GUIOT & CIE. 5 March, 1968 [3 Nov., 1967], No. 10555/68. Addition to 1,196,459. Heading F2V. The valve of the parent Specification is im- proved, in that the spring 14, 23 is located by an abutment 10a spaced from the seat 1, a first part 14 of the spring having at least two convolutions 15 bearing on the flexible impermeable dia- phragm 5 and extending radially over the seat opening 4, and a second part 23 of the spring extending axially to engage the abutment. This arrangement enables the diaphragm 5 to flex upwardly from the centre under warm con- ditions when the diaphragm is more pliable, whilst under cold conditions when the diaphragm tends to become rigid, it lifts bodily from the seat.

FIG. 1.



PATENT SPECIFICATION (11) 1 210 013

DRAWINGS ATTACHED

1 210 013

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(61) Patent of Addition to No. 1 196 459 dated 1 Aug. 1967
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F2V E1L2 J2X

(54) IMPROVEMENTS IN OR RELATING TO DIAPHRAGM CHECK VALVES

(71) We, ETABLISSEMENTS GUIOT & CIE, formerly known as Etablissements A. Guiot, a French Body Corporate, of 80 Route de Saint-Cloud 92- Rueil-Malmaison, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to diaphragm check valves which comprises a flexible diaphragm adapted, by fastening and centering means (rivet, axle, for example) to be applied on a rigid seat having a passage formed by at least one opening arranged to be masked by the diaphragm.

The invention is more particularly, but not exclusively, concerned with check valves intended to equip diaphragm pumps for drawing in and driving out fluids, especially liquid motor fuels.

The invention concerns improvements in the invention of our copending Application No. 35241/67 (Serial No. 1,196,459), which provides a diaphragm check valve which comprises a flexible, impermeable diaphragm which is adapted, by fastening and centering means, to be engaged with a rigid seat having a passage formed by at least one opening adapted to be masked by said diaphragm, prestressed coil spring means being interposed between the diaphragm and a fixed axial abutment situated, with respect to said diaphragm, on the side thereof remote from the seat of the valve, the spring means being arranged so that the diaphragm is held, in the closed position of the valve, against the seat along at least two substantially annular, essentially coaxial zones situated respectively, from a radial point of view, at least one radially inwardly of the passage formed in the seat and at least one radially outwardly of the passage in the seat.

[*Price 5s. 0d. (25p)*]

It is an object of the present invention to improve the practical performance of such a diaphragm check valve, *inter alia* so that it may operate satisfactorily at low temperatures at which the diaphragm is less flexible.

According to the main improvement provided by this invention, an axial clearance is left between the axial abutment and the diaphragm so that to open the valve the diaphragm may either deform resiliently at normal temperatures while its central part is retained in engagement with the seat by the action of the spring means or, when of reduced flexibility at low temperatures, be disengaged completely from its seat against the force of the spring means.

Whilst the spring means is preferably formed integrally, it is possible for two spring parts to be provided, namely a cylindrical coil spring and a flattened helical coil spring.

In order that the invention may be more clearly understood, an embodiment thereof will now be described, by way of example only, with reference to the accompanying drawing, in which:

FIGURE 1 is a view in axial section of a diaphragm valve according to the invention;

FIGURE 2 is a view in axial section showing the valve of Figure 1 in the open position at a normal temperature of the diaphragm; and

FIGURE 3 is a view in axial section in which the valve of Figs. 1 and 2 is shown in the open position when the diaphragm is at a low temperature.

The exemplary valve shown in the drawing comprises a rigid seat 1 which is preferably circular and is adapted to be disposed in a pump casing (not shown). A central hole 3 and openings 4 are formed in the seat 1.

A flexible, impermeable diaphragm 5

(also preferably circular) has a central hole 6*a* and is adapted to be applied to the seat 1 to mask the openings 4.

Means for fastening and centering the diaphragm 5 on its seat 1 are provided, and advantageously comprise a rivet 7*a* having a cylindrical body 8 adapted to extend through the hole 6*a* in the diaphragm 5 and through the central hole 3 in the seat 1, one end 9 of the rivet body being adapted to be riveted to the face of the seat remote from the face on which the diaphragm is applied.

According to the application No. 35241/67, Serial No. 1 196 459, a helical spring 14 is interposed between the diaphragm 5 and an axial abutment situated on the side of the diaphragm 5 which is remote from the seat, the radially innermost convolution 15 of spring 14 is retained axially by the axial abutment, the spring 14 once positioned being axially compressed and engaging the diaphragm 5 by acting radially inwardly and outwardly of the openings 4. Also, the action of the spring 14 on the diaphragm 5 is improved by a washer 22 disposed between the convolution 15 and the central part of the diaphragm 5. In the parent application, the rivet 7*a* has a cylindrical portion 13*a* bearing on the seat 1 and receiving the diaphragm 5, and a head 10*a* on whose bottom portion the convolution 15 bears. Consequently, the central portion of the diaphragm 5 cannot generally be moved axially. In operation, the peripheral part of the diaphragm 5 rises to allow the fluid to pass by, but the central part of the diaphragm 5 remains in engagement with the seat 1.

According to this invention, an axial clearance is left between the axial abutment and the diaphragm so that to open the valve the diaphragm may either deform resiliently at normal temperatures, the central part of the diaphragm being retained in engagement with the seat 1 by the spring, or, at low temperature at which the diaphragm is of reduced flexibility, the diaphragm may disengage axially from its seat adjacent the centering means and against the force of the spring.

To this end, in the embodiment shown in the drawing, the cylindrical portion 13*a* which bears on the seat 1 *via* a shoulder 12 has an axial length considerably greater than the sum of the thickness of the diaphragm 5, washer 22 and the convolution 15, and the resilient means comprise, in addition to a helical spring portion 14, a spring portion 23 such as a cylindrical coil spring portion. In the embodiment shown in the drawing, the spring portions 14 and 23 are formed integrally which, when in the inoperative state, has a circular-helix top portion extended by a conical-helix bottom portion and which, once positioned and with the valve closed, is biased so as to have its circular-helix portion compressed and its conical-helix portion flattened against the diaphragm 5.

A description will now be given with reference to Figs. 2 and 3, of how the exemplary valve operates when the diaphragm 5 is at normal or hot temperature and at low temperature. When the diaphragm is at or above normally experienced temperatures — that is when the ambient temperature is high enough, for example above 0°C — or after the elements in which the valve operates have heated up, the diaphragm is flexible and deforms readily when fluid applies pressure to that side of the diaphragm which abuts the openings 4, the diaphragm 5 then rising and being resiliently deformed by the force of the spring portion 14. The latter deforms and thus transmits an axial load via its convolution 15 to the spring portion 23 which, if experiencing very little axial biasing, compresses slightly or, if experiencing sufficient biasing, stays in the position associated with the valve being in the inoperative state (Fig. 1), in which event the central part of the diaphragm 5 remains in engagement with the seat 1 (Fig. 2).

When at a low temperature, however, the diaphragm 5 is relatively rigid and so cannot deform resiliently. When the fluid applies enough pressure to the diaphragm 5, the same rises bodily like a washer and moves with it the washer 22 and the spring portion 14. The diaphragm slides along the cylindrical portion 13*a* (Fig. 3) against the force of the spring portion 23 until it reaches an equilibrium position. To prevent jamming, the apertures 6*a*, 22*a* in the diaphragm 5 and washer 22 are such that the diaphragm 5 and washer 22 have adequate radial clearance on the part 13*a*. If the diaphragm 5 heats up subsequently in operation, its central part — which is the part which is experiencing the strongest axial action by the spring portions 14, 23 — becomes less rigid in proportion as the diaphragm 5 becomes more flexible, until the diaphragm 5 is warm enough to take up the position shown in Fig. 2.

Since the spring portion 23 is prestressed when the valve is in its inoperative position (Fig. 1), the pressure of the fluid at low temperature must be greater than the pressure required at normal temperature if the central part of the diaphragm is required in operation not to disengage from the seat 1. However, the spring portions 14, 23 can be made so stiff and can be so biased that the diaphragm 5 rises slightly off its seat even at normal temperatures.

WHAT WE CLAIM IS:—

1. A diaphragm check valve which comprises a flexible, impermeable diaphragm which is adapted, by fastening and centering means, to be engaged with a rigid seat having a passage formed by at least one opening adapted to be masked by said diaphragm, prestressed coil spring means being interposed between the diaphragm and a fixed axial abutment situated, with respect to said diaphragm, on the side thereof remote from the seat of the valve, the spring means being arranged so that the diaphragm is held, in the closed position of the valve, against the seat along at least two substantially annular, essentially coaxial zones situated respectively, from a radial point of view, at least one radially inwardly of the passage formed in the seat and at least one radially outwardly of the passage in the seat, an axial clearance being left between the axial abutment and the diaphragm so that to open the valve the diaphragm may either deform resiliently at normal temperatures while its central part is retained in engagement with the seat by the action of the spring means, or, when of reduced flexibility at low temperatures, be disengaged completely from its seat against the force of the spring means.

2. A valve according to Claim 1, wherein the spring means is such that, when in the inoperative state, it has one part in the form of a cylindrical helix adapted to bear on the abutment and a part in the form of a flattened helix adapted to be applied to the diaphragm.

3. A diaphragm check valve, substantially as hereinbefore described with reference to, and as shown in the accompanying drawing.

4. A diaphragm pump incorporating a diaphragm check valve of any one of the preceding claims.

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1,210,013
1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1.

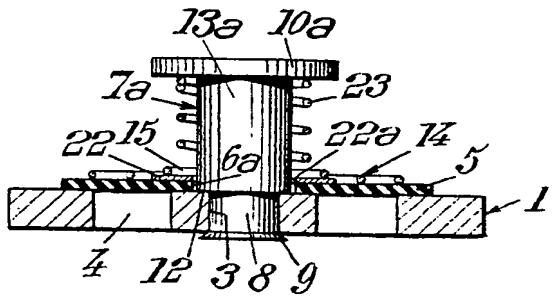

Fig. 2.

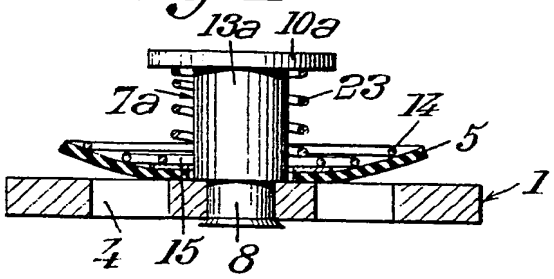

Fig. 3.